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Department of Community and  
Economic Development



ROBERT C. FUEHR  
Director

Division of Business and  
Economic Development



Office of  
Technology Development

324 South State Street, Suite 500  
Salt Lake City, Utah 84111  
(801) 538-8616  
Fax (801) 538-8888

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**CENTERS • OF  
EXCELLENCE**

**ANNUAL REPORT**

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# 2000-2001 Centers of Excellence Annual Report



# Executive Summary



## **Executive Summary**

The Utah State Legislature established the Centers of Excellence Program (COEP) in 1986. They recognized that the growth of new industry and expansion of existing industry is highly dependant on a strong technology base, new ideas, concepts, innovations, and prototypes. Furthermore, the Legislature approved the annual allocation of economic development funds to the COEP, to be awarded to college and university faculty on a competitive basis.

The goals of the COEP are to enhance and expand selected applied research and development activities, at Utah's institutions of higher education, focused on the development of technologies, which have potential for economic development in the state; and to assist in the actual commercialization of those technologies, in concert with the technology licensing offices at the respective institution. The proprietary value of technologies created is reflected in the number of patents/copyrights issued, which produce royalty-bearing licenses that are signed by businesses. The economic impact is the sum effect of the creation of new companies, the enhancement of business opportunities for existing companies that license COEP technologies, and in the growth of Utah's job opportunities.

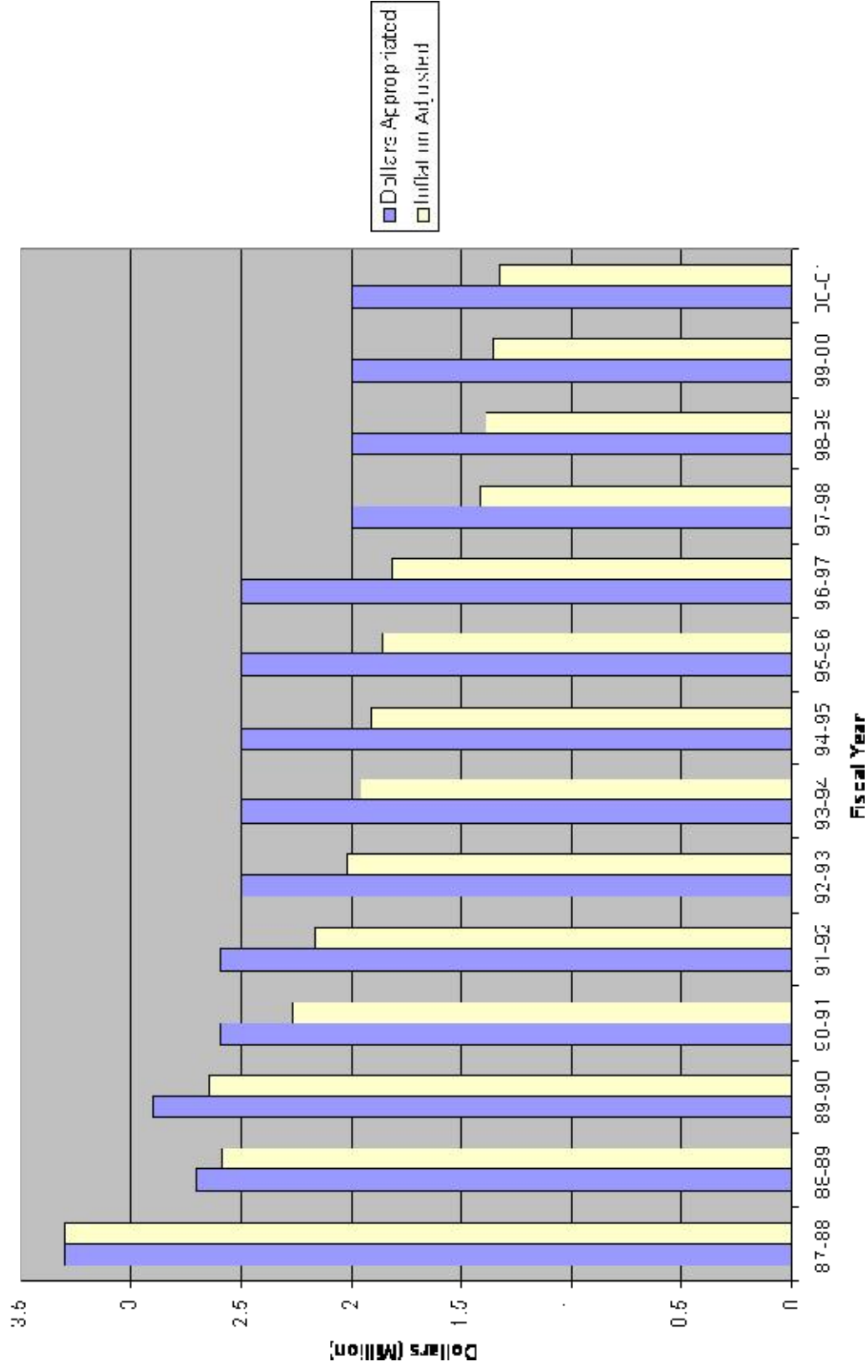
During the 2000-2001 fiscal year the Centers Program issued \$1.870 million in grants to 16 active Centers for use in bringing significant new technologies closer to the marketplace. In the competitive selection process, 10 centers received continued funding and 6 new centers were selected for funding. The Center distribution with respective funding was as follows: seven at University of Utah (\$900,000), four at Utah State University (\$460,000), and four at Brigham Young University (\$460,000). In addition, the program also funded the commercialization consulting effort, at a level of \$7,000 per funded Center, for a total of \$112,000.

The 16 Centers received matching funds of \$13.4 million, resulting in a matching fund ratio of 7.2 to one. The cumulative state funding for the COEP between 1986 and 2001 was \$33.7 million and the cumulative matching funds received was \$356.1 million, resulting in a matching fund ratio of 10.6 to one. This is believed to be the highest in the nation for programs of this kind and represents a critically important leverage for success in the program.

Over the full life of the program, intellectual property created by faculty participating in the Centers of Excellence accounts for 170 patents resulting in 197 license agreements. Since the inception of the program, 142 companies have been created and licensed proprietary technology from the program. Currently, companies that trace their origins to the Centers of Excellence Program employ an estimated 1300 persons, in the high technology sector of the economy. The wage for this workforce averages of \$68,000.

The Centers of Excellence Program continues to be one of the nations most successful technology commercialization programs as measured by matching dollars, significant new commercialized products, and state economic impact. With strong emphasis on the importance of commercialization the program will have an ever expanding and important role to play in Utah's economic future.

# Centers of Excellence Funding History



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# Program Description



# PROGRAM DESCRIPTION

## ECONOMIC IMPACT ON THE STATE OF UTAH FOR THE PAST FIVE YEARS

As of the close of the 2000-2001 fiscal year, the direct economic impact from the Centers of Excellence program on the State of Utah is 1,336 jobs created with an average wage of \$68,000. The total direct and indirect impact is approximately 3,000 jobs created with an average wage of \$61,600. (These numbers were gathered by the economic research office of the Department of Community and Economic Development.)

## BACKGROUND

The Utah State Legislature created the Centers of Excellence Program (COEP) in 1986 recognizing that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. The Legislature recommended the allocation of economic development funds each year to the COEP, to be awarded to college and university faculty on a competitive basis. The objectives of the COEP are to enhance and expand the applied technical research activities at institutions of higher education in Utah, to develop technologies that are considered to have potential for economic development in the state, and to assist in the actual commercialization of those technologies. This research and technology commercialization process ultimately results in the creation of new companies, the enhancement of business opportunities for existing companies that license COEP technologies, and in the growth of Utah's job opportunities. In addition, the proprietary value of technologies created is reflected in the number of patents issued and the associated royalty-bearing licenses that are signed.

These measurement parameters (jobs created, companies assisted and/or created, inventions disclosed or patents issued, and license agreements signed) are summarized in this report as indicators of the value of the COEP to state economic development.

Ongoing funding of the program has been based upon the real and potential economic impact that the Centers of Excellence Program has had upon the State of Utah during the years since its creation. This Annual Report summarizes the significant accomplishments of the program during the recently completed fiscal year and attempts to identify the long-term economic value of that work.

## **OPERATIONS AND OBJECTIVES**

The operating methods of the Centers Program have evolved over the years since its inception with a continuing goal of achieving the maximum economic benefit from the individual Centers that have been created. Upon selection on a competitive basis, new Centers are funded with a minimum requirement of a 2:1 matching fund ratio from the private and federal sectors. Matching funds are reported and audited on a regular basis. Centers are also audited regularly for the achievement of technical and commercial milestones. Center directors are required to submit annual reports to the COEP director. The Centers of Excellence Program Annual Report, here attached, is based on submitted reports and upon information gathered from site visits, audits and other data sources. In addition, each funded Center is assisted by one or more designated commercialization consultants who assist Center directors in defining commercialization strategies, performing market and competitive analysis and locating potential investors or licensees.

Centers are normally funded for a maximum of five years and are then expected to be self-sustaining through license contract royalties and new research grants. Centers with especially noteworthy histories and ongoing technological impact are designated as Distinguished Centers and thereafter may be funded on a project-by-project basis as requests are approved.

## **CENTER SELECTION PROCESS**

Proposals from researchers for new Centers of Excellence or for renewal of existing Centers of Excellence are submitted to the COEP office in response to a Request for Proposal which is normally sent in late December. The incoming proposals are critically reviewed by the Centers of Excellence Advisory Council. Centers are selected for funding based on a ranking established in extended review sessions with the Centers Advisory Council.

Since its inception, and through FY 2000-01, the program has created 95 Centers of Excellence, seven of which have been designated as Distinguished Centers, 55 have graduated, and 16 are active during this reporting period.

The State Advisory Council for Science and Technology has advisory responsibility for the Centers of Excellence Program by statute. Members of the Science Council participate on the Centers Advisory Council in reviewing proposals and conducting site visits. This provides Science Council members with in-depth knowledge of the program, Center specific information and a strong technical and industrial perspective for making funding decisions. The State Science Advisor reviews the Annual Report and presents it to the Science Council for acceptance. The Director of the Office of Technology Development serves as an ex-officio member of the State Advisory Council for Science and Technology.

## **COMMERCIALIZATION PROCESS**

Over the past five years, the Centers of Excellence Program has funded a consulting program to assist Center directors in preparing and implementing commercialization strategies. Each Center is unique in terms of which strategy is optimal - there is no single solution and each requires customized approaches.

Early market surveys and competitive analysis are conducted to discover which market segments are most promising and which product features will be of interest to potential customers and licensees. Consultants assist in targeting potential licensees for the technology and in positioning products for anticipated markets.

These early strategic discussions often reveal product variations that can be introduced to the marketplace earlier than previously planned. Such early commercialization has several benefits: (i) getting products to consumers for preliminary market validation and directional planning; (ii) early cash flow strengthens continuing research at the Center and hastens financial independence and; (iii) the future value of technology licenses are enhanced.

The Centers of Excellence Office works closely with the Technology Transfer Offices at the respective universities in an effort to extract maximum value from the licenses that are signed for Centers technologies. Through the commercialization consulting program, assistance is given in defining market opportunities, identifying potential target licensees, providing key information for license valuations, and consulting assistance to those companies considering license opportunities.



# 2000-2001 Funded Centers

# ACOUSTIC COOLING

## CENTER

The Center for Acoustic Cooling Technologies has been established for the application of thermo acoustic devices to heat management and heat removal from microcircuits, computers, high speed electronics, and small scale applications.

*Industrial collaboration with a  
local company  
Venture Capital Investments from  
SUTI*

## ACCOMPLISHMENTS

This is the first year for the Center for Acoustic Cooling. It is structured on fundamental developments of miniature thermo-acoustic devices supported by the Office of Naval Research, the interfacing of devices to microcircuits and computers as supported by DARPA (HERETIC Program), and industrial collaboration with a local company, for the development and commercialization of Center technologies. This effort has attracted the interest of a venture capital investment company, SUTI, in California.

## UNIVERSITY OF UTAH

*Can you imagine.....*

A miniature cooling device that replaces fans in airplane cockpit displays and personal computers using sound as the main energy source and measures from 4 cm to less than 1 cm?



## TECHNOLOGY

The center's technology is based on two effects in thermo acoustics. The first is that heat can be converted into sound energy; and second, sound can pump heat. Both have been developed into devices with dimensions ranging from 4 cm to 0.8 cm with the possibility for further miniaturization and micro-circuit integration.

## Contact Information

**Director: Orest G. Symko**  
University of Utah  
115 South 1400 East #201  
Salt Lake City, Utah 84112  
801-581-6132  
orest@physics.utah.edu

# ADVANCED JOINING OF MATERIALS

## CENTER

The Center for Advanced Joining of Materials (CAJM) is developing enhancements and new technologies in friction stir welding (FSW). FSW is a relatively new innovative joining technology that is revolutionizing the way in which aluminum and copper materials are being joined. The objectives are to develop enhancements to this existing technology that will broaden the use of this process in new materials and applications.

## TECHNOLOGY

The Center is currently focused on the development and marketing of three technological aspects of FSW: 1) tooling that will last longer, offer the ability to join a wider range of advanced materials, and enable better control of the resulting quality of weld and properties, 2) new control systems and hardware for large scale three-dimensional FSW capabilities; and 3) new methods and novel tooling for joining polymeric materials.

## ACCOMPLISHMENTS

All of the first-year milestones have been met. To date, the Center has submitted three provisional patents. Of these, BYU has issued an exclusive license for the patent on super abrasive tools to a local Utah company. Co-development and marketing of these tools are continuing. BYU is presently seeking a partner for co-development on the FSW of polymeric materials. With respect to the direct machining and controls patent, BYU held a meeting in May at which a direct machining prototype was demonstrated. Those in attendance included Ford Motor Company, The Boeing Company, Intel, and Aires (Japan). Of those in attendance, there was a strong agreement that these companies wanted this technology to be moved to commercialization as soon as possible.

## BRIGHAM YOUNG UNIVERSITY

*Can you imagine.....*

**A new method for welding metals and plastics that does not melt the material, does not add new material, and forms a joint that is base metal strong and virtually undetectable from the surrounding material?**



As a result, BYU is presently establishing a consortium of end-users to fund the final phases of development. Likewise, BYU is seeking a business partner through which this technology can be licensed and marketed.

*Exclusive Licensing agreement  
signed with a Utah company  
3 provisional patents submitted*

## Contact Information

**Director: Tracy Nelson, Ph. D.  
Brigham Young University  
Provo, Utah  
801-378-6233 Fax 801-378-7575  
tracy\_nelson@byu.edu**

# ADVANCED STRUCTURAL COMPOSITES

## CENTER

The objective of the Center for Advanced Structural Composites is to develop the commercial potential of the IsoTruss technology. The IsoTruss enables the creation of super lightweight grid structures with the potential of revolutionizing industries as diverse as civil infrastructure (e.g., communication and construction) aerospace, automotive, marine and sporting structures, virtually in any application area requiring high strength, high stiffness, light weight and superb corrosion resistance.

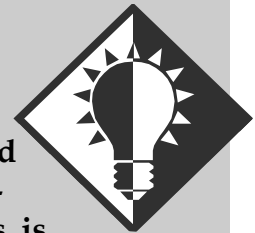
## TECHNOLOGY

The core technology consists of an ultra-lightweight composite structural shape known as the IsoTruss. The IsoTruss is a novel, patented three-dimensional structural form that takes advantage of the highly directional properties of high strength composites to produce an extremely efficient and lightweight structure. The IsoTruss incorporates stable geometric configurations with helical members that spiral in opposing directions around a central cavity, coupled with longitudinal members that pass through the intersections.

## BRIGHAM YOUNG UNIVERSITY

*Can you imagine.....*

A power line transmission tower that can withstand extreme wind conditions, support tremendously heavy loads, is corrosion free, is unaffected by temperature extremes, and weighs significantly less than conventional steel towers?



## ACCOMPLISHMENTS

Several companies are currently negotiating licensing agreements with BYU. This technology, along with expanding applicability, should provide many commercial and engineering solutions to structural problems.

## Contact Information

**Director: David W. Jensen**  
Brigham Young University  
368 Clyde Building, Box 24066  
Provo, Utah 84602  
801-378-2094  
david@byu.edu

# BIOMEDICAL OPTICS

## CENTER

The goal of the Center for Biomedical Optics is to commercialize optical technologies for diagnostic, therapeutic and disease risk assessment in medicine. Recent advances in novel light sources, laser materials and laser spectroscopy make these optical techniques highly attractive for novel, non-invasive assessment.

## TECHNOLOGY

The Center's technologies include Resonant Raman Scattering detection of carotenoid antioxidants in human tissue and a novel light source for biomedical spectroscopy.

## ACCOMPLISHMENTS

Nutriscan, Inc. was formed during the second year of COEP funding and negotiated a license for our US Patent No. 6,205,354B1: Method and Apparatus for Noninvasive Measurement of Carotenoids and Related Chemical Substances in Biological Tissue. This patent was issued March 20, 2001 for technology supported by earlier COEP funding. The other Center technologies are anticipated to require further development with COEP funding before commercialization can occur.

## UNIVERSITY OF UTAH

*Can you imagine.....*

**A non-invasive optical laser technique that can detect and treat cancerous cells in the skin or mucosal tissue??**



*Licensed 2 fields of use,  
one patent issued*

## Contact Information

**Director: Werner Gellerman**  
**University of Utah**  
**115 South 1400 East #201**  
**Salt Lake City, UT 84112**  
**801-581-5222**

**werner@mail.physics.utah.edu**

# BIOREMEDIATION

## CENTER

The Center for Bioremediation was established to channel research, development and marketing of innovative heavy metal removal, recovery and pollution prevention biotechnologies into a valuable resource for WSU and Utah. The Center's focus technology is biological selenium removal. Additionally, technologies include arsenic removal and cyanide degradation.

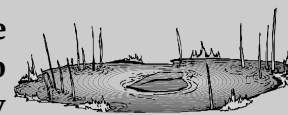
## TECHNOLOGY

The Center's biotechnologies are based on research conducted by the Center's principal investigators; and over 7.7 million US Bureau of Mines (USBM) research dollars are invested in the development of metal bioremediation technologies. At the forefront of the Center focus technologies is a field-proven selenium removal technology capable of economically removing this contaminant from wastewaters to a point below detection. The Center's selenium technology is based on a novel implementation path requiring a thorough front-end analysis, specially adapted, naturally occurring microorganisms, and a patent-pending proprietary process of configurations. This path provides unique bioremediation technologies that are more economical, faster and more durable than other technologies.

## WEBER STATE UNIVERSITY

*Can you imagine.....*

A faster and more economical way to remove heavy metals, such as arsenic or cyanide, from wastewaters to a point below detection, with naturally occurring microorganisms?



## ACCOMPLISHMENTS

The Center's technology has been demonstrated to be approximately 1/10 the cost of EPA's past BDAT and removes selenium to lower levels. A final EPA report is expected later in 2001. The Montana site was viewed as a showcase site for selenium removal.

*Technology is 1/10 the cost of past BDAT and removes selenium to lower levels*

## Contact Information

**Director: Jack Adams**  
**Weber State University**  
**2515 University Circle**  
**Ogden, UT 84408**  
**801-626-6058**  
**djadams@weber.edu**

# CELL SIGNALING

## CENTER

The Center for Cell Signaling (CCS) develops and commercializes new technologies that are important to the treatment of cancer, allergy, asthma and inflammation. CCS has 20 participating faculty from eight different departments at the University of Utah, one faculty member from Brigham Young University and two from Utah State University, focusing their talents in a synergistic way to create and commercialize new technologies.

## TECHNOLOGY

The CCS focuses on the synthesis and drug applications of new molecules involved in cell to cell communication, from controlling the biochemical pathways of signal transduction to designing instruments used to study these processes. Current developments include tools necessary for the elucidation of chemical pathways that regulate normal and abnormal cell responses. These tools include chemical synthesis, expression of recombinant proteins, preparation of monoclonal antisera, biomolecular interaction analysis and phage display of high affinity peptides. New methods are being developed to assay for signal binding and processing proteins, utilizing high throughput screening.

## ACCOMPLISHMENTS

The Center faculty continues to excel in inventions. This year they filed 21 invention disclosures, 20 patents or provisionals on June 30, 2001. Two companies have been spun off using Center technology, Salus Therapeutics, Inc and Echelon Research Laboratories. Salus (established 1999), focuses on identifying ribozyme and antisense targets for specific diseases. The company has research collaborations with the Center and has received two SBIR awards totaling over \$850,000.

*continued....*

## UNIVERSITY OF UTAH

*Can you imagine.....*

**A new class of pharmaceuticals that provide therapeutic effects by artificially signaling selected cells in the body to perform desired actions to the benefit of the patient?**



Echelon Research Laboratories, established in 1998, markets reagents and kits for identifying oncogene activators and suppressors important in cancer diagnosis. Echelon received six SBIR/STTR awards totaling over \$2 million and has successfully licensed Center technologies, which are now in production.

*21 Invention Disclosures  
Two technology licenses signed  
Two spin-off companies*

## Contact Information

**Director: Glenn Prestwich**  
**University of Utah**  
**421 Wakara Way, #360**  
**Salt Lake City, UT 84108**  
**801-585-9704**  
**gprestwich@deans.pharm.utah.edu**

# COMPLIANT MECHANISMS

## CENTER

The objective of Compliant Mechanisms is to accelerate and streamline the development and commercialization process of compliant mechanisms so that they may be quickly licensed to existing or new companies. The use of innovative and patented compliant mechanisms will give existing companies a clear competitive advantage and will provide a unique and valuable product for new companies. The potential market applications and opportunities are immense.

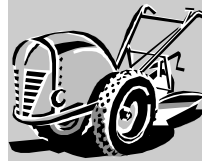
## ACCOMPLISHMENTS

Some examples of compliant mechanisms that have been designed and tested are: fishing reel, bicycle freewheel, derailleur and brakes, pull start for small gasoline engines, centrifugal clutches, string trimmer, small garden tiller clutch, go-cart clutch, continuously variable transmissions (CVT), general purpose belt drive CVT, second generation bicycle CVT prototype, bistable mechanisms, compliant parallel motion mechanisms, constant-force mechanisms, electrical contacts for PDA docking stations, fully compliant bistable micro mechanism, thermal actuators, linear motion micro-bistable mechanism and two position latching mechanism.

## BRIGHAM YOUNG UNIVERSITY

*Can you imagine.....*

A method for redesigning any complex mechanical part to significantly reduce the numbers of parts, simplify the manufacturing process, reduce costs and end up with a more reliable and wear-resistant device?



## TECHNOLOGY

The Center possesses methods for the design of compliant mechanisms that have reduced part count and reduced cost and increased precision compared to conventional mechanisms. A number of specific classes of mechanisms have been investigated and developed for commercialization.

## Contact Information

**Director: Spencer Magleby**  
**Brigham Young University**  
**435 CTB**  
**Provo, UT 84602**  
**801-378-3151**  
**[magleby@byu.edu](mailto:magleby@byu.edu)**

# DAIRY TECHNOLOGY COMMERCIALIZATION

## CENTER

The Center for Dairy Technology Commercialization was established to commercialize technologies developed at the Western Dairy Center, whose research is funded by a consortium of dairy food companies, for a variety of applications in the dairy industry.

## TECHNOLOGY

The Center is currently pursuing commercialization of the following inventions: utilization of bacterial cultures that produce polysaccharides externally to increase cheese yield; production of flavored cheese using high pressure injection technology, using textured whey protein both as a meat extender and as a high protein snack food.

*A new company was formed  
and is based in Tooele, Utah.*

## Contact Information

**Director: Carl Brotherson**  
Utah State University  
NFS, 8700 Old Main Hill  
Logan, UT 84322  
435-797-3466  
wcdprt@cc.usu.edu

## UTAH STATE UNIVERSITY

*Can you imagine....*

A new method of  
modifying cheese flavor  
by using high-  
pressure injection technology?



## ACCOMPLISHMENTS

Cheese trials have begun using the exopolysaccharide gene to determine commercial interest among cheese producers. A new injector was manufactured and sample product was sent to potential users of the technology. Two commercial companies are currently evaluating the technology. One company intends to modify the cheese flavor and the other company will use the technology as a method of creating new and novel cheeses for children.

# ELECTRONIC MEDICAL EDUCATION

## CENTER

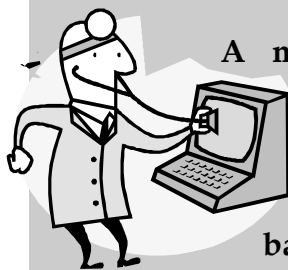
The Center for Electronic Medical Education (CEME) is part of the Electronic Medical Education Resource Group (EMERG) in the Department of Radiology at the University of Utah (U of U). The overall goal of the CEME is to develop and commercialize component software originally created by EMERG that streamlines the collection, creation, access and retrieval of image intensive teaching and reference data. These needs addressed by EMERG are prevalent at medical institutions around the world. The focus of this center is to develop component software tools for use by end users and specialists in image intensive fields, specifically targeted towards the case creation and information management needs.

## TECHNOLOGY

The center continues the development of software to streamline the use of image intensive teaching and reference data in medicine. The software consists of author and platform tools used to create medical reference and education products as part of a component based information management and processing system. The software tools will be used by both authors and end-users to continuously update the medical reference image data.

## UNIVERSITY OF UTAH

*Can you imagine.....*



A medical doctor who comes across a case he has not seen before, taps into a medical image database and accesses the most current database of images and case studies to help improve patient diagnosis instantaneously?

## ACCOMPLISHMENTS

All of the software that has been developed within EMERG and the Center is owned by the U of U since its development involved significant use of University resources. Two technology disclosures have been submitted. Those disclosures are Medical Image Annotation Tool and publishing software (beans) for image-oriented print and digital outputs (screen display via CD-ROM, DVD, on-line, etc).

## Contact Information

**Director: Ric Harnsberger/Anne Osborn**  
**University of Utah**  
**729 Arapen Drive**  
**Salt Lake City, UT 84108**  
**801-581-4624**  
**ric.harnsberger@hsc.utah.edu**  
**anne.osborn@hsc.utah.edu**

# INTELLIGENT COMPUTER TOOLS

## CENTER

The Center for Intelligent Computer Tools "graduated" this year. This was the fifth year of funding. The Center focuses on interactive image segmentation, composition and digital image editing, automated creation/browsing of digital (microfilm) libraries, semi-automated creation of virtual environments-especially with Virtual Venues for the 2002 Winter Olympics

## TECHNOLOGY

The technology development effort concentrates in Intelligent Scissors/Paint, represents full color images with limited palette and no visual loss, resolution enhancement to improve (internet) image appearance through data dependent triangulation; document understanding; automated zoning and browsing of digital documents by content; line intersection: automated object-based line intersection for recovery of 3D (building) geometry; virtual environments: creation of realistic virtual environments (Olympics, BYU) from real-world images; image blending: automatic shape blending and image object blending, object-based image editing: ungroup, delete, texture synthesis; image-based object modeling: photographic based resolution enhancement of objects

*License agreements signed  
with Park City Entertainment  
and Adobe Systems*

## BRIGHAM YOUNG UNIVERSITY

*Can you imagine.....*

Careening down an Olympic bobsled run, aware of the twisting turns and angles of the sled while watching the surrounding landscape rush by, all on your computer screen with every visual sensation artificially created by software?



## ACCOMPLISHMENTS

Algorithms for intelligent paint segmentation and localization were updated with high level visual effects. The prototype digital microfilm parser/browser was enhanced with significant new tools. The virtual environment terrain database for the Virtual Olympics was expanded and terrain details such as buildings, a bobsled run, and ski runs were added. Additional license agreements were signed with Adobe Systems and Park City Entertainment.

## Contact Information

**Director: William A. Barrett**  
Brigham Young University  
Dept. of Computer Science  
Provo, UT 84602  
801-378-7430  
barrett@cs.byu.edu

# MICROBE DETECTION & PHYSIOLOGY

## CENTER

The focus of this center is the development of technologies that lead to the real time detection of pathogenic micro-organisms. This involves the development of novel pathogen capture molecules, platform development, prototype development, and commercialization. Industries where this technology is useful include pharmaceuticals, biomedicine, biotechnology, veterinary, production agriculture, food processing, public health, defense, and water and sewage treatment.

## TECHNOLOGY

The primary focus of the Center is bacterial detection, but other targets are also investigated. To date, four technologies are under development: ImmunoFlow, ImmunoDNA, GlycoBind, and TissueTag. Each technology has a unique use and application but is not limited to a single type of use. For example, ImmunoFlow has many fields of use ranging from water to air and has the potential to detect many types of bacteria. Initial prototypes are available for *Bacillus globgii* spores, *Lactobacillus*, *Salmonella* and *E. coli* O157 cells. Each type of assay has a maximum detection time of 30 minutes with a sensitivity of less than 10 cells. A unique feature of each technology is that it is volume independent; both large (tens of liters) and small (1 to 100 milliliters) samples are commonly used. Each technology is at a different stage of development with ImmunoFlow being the most developed.

## UTAH STATE UNIVERSITY

*Can you imagine.....*

Being able to detect less than 10 cells of a harmful pathogen, such as salmonella or *E. coli*, for example in milk, within 30 minutes?



## ACCOMPLISHMENTS

ImmunoFlow is under a license option agreement. A fully automated beta-prototype has been built to run ImmunoFlow.

*Each technology has a unique use and application but is not limited to a single type of use.*

## Contact Information

**Director: Bart Weimer/Marie Walsh**  
**Utah State University**  
**NFS, UMC 8700**  
**Logan, UT 84322**  
**435-797-3356**  
**milkbugs@cc.usu.edu**  
**mkwalsh@cc.usu.edu**

# MULTI-DIMENSIONAL INFORMATION

## CENTER

The Center for the Representation of Multi-Dimensional Information (CROMDI) was established to commercialize audio-visualization technology (IntuInfo) that facilitates the rapid and accurate analysis of large quantities of quickly changing data. CROMDI is an interdisciplinary team dedicated to the innovative representation of information, comprised of experts in the fields of Architecture, Computer Science, Anesthesia, BioEngineering, Finance, Mathematics, Psychology, Communication and Music. These diverse experts participate with their own unique perspectives and provide solutions to complex information design needs through a unique methodology and iterative process.

## TECHNOLOGY

By visually displaying multiple variables using various objects and colors, a wide range of information is clearly presented. The association between the graphical objects and the data is designed to facilitate rapid understanding of large quantities of data. To be "state of the art" in many fields is to represent information with tables of numbers, waveforms, pie charts, diagrams, icons and matrices. IntuInfo enables recognition of events that is significantly faster, more accurate, less mentally demanding and with less training than is possible using existing technologies. This patent pending technology has been applied in medicine, finance, and entertainment, and may also be successfully utilized in other applications where decision making depends on monitoring or analyzing large quantities of information.

## UNIVERSITY OF UTAH

*Can you imagine....*

A new audio-visualization technology that facilitates the rapid and accurate analysis of large quantities of quickly changing data, such as stock market information?



## ACCOMPLISHMENTS

Filed 5 patent extensions: 3 for medicine, 1 for finance and 1 for inertia; 3 additional medical display technology modules and enhancements; sponsored research by GE Medical Systems with an option to license financial display prototype. Market and sponsored research and licensing discussions with potential partner.

## Contact Information

**Director: Stefano Foresti**  
**University of Utah**  
**155 South 1452 East, #405**  
**Salt Lake City, UT 84112**  
**801-581-3176**  
**stefano@chpc.utah.edu**

# PETROLEUM RESEARCH

## CENTER

The mission of the Petroleum Research Center (PERC) at the University of Utah is to conduct research and development studies leading to practical, cost-effective solutions to liquid hydrocarbon production, handling and transportation. With funding from the U.S. Department of Energy and the petroleum industry, the PERC coordinates basic and applied research in: the physical properties and physical and chemical thermodynamics of naturally occurring hydrocarbons, development of pipeline transportation and flow assurance strategies, and simulation, optimization and control of oil and gas recovery methods.

## TECHNOLOGY

Petroleum Research Center (PERC) was funded to commercialize and market two specific areas of work; understanding problems related to production, transportation and processing of waxy and asphaltenic crude oils and subsequent alleviation of these problems and developing a variety of methods and software tools (models) for the efficient and optimal production of oil and gas from underground reservoirs. Over the last several years, oil companies and federal agencies have funded (and continue to fund) research in PERC, which is an integral part of the Department of Chemical and Fuels Engineering at the University of Utah.

## UNIVERSITY OF UTAH

*Can you imagine.....*

A variety of methods and software tools for the efficient and optimal production of oil and gas from underground reservoirs?



## ACCOMPLISHMENTS

Applicability of the discrete-fracture model demonstrated technology for wax measurement developed. First generation of thermodynamic and pipeline flow models complete.

### Contact Information

**Director: Milind Deo**  
University of Utah  
50 South Central Campus Drive  
Salt Lake City, UT 84112  
801-581-7629  
[mddeo@eng.utah.edu](mailto:mddeo@eng.utah.edu)

## PROFITABLE USES OF AGRICULTURAL BYPRODUCTS

### CENTER

The Center for Profitable Uses of Agricultural Byproducts was established to strengthen the economy of Utah, particularly the rural economy, by working closely with farmers and ranchers and other agricultural related businesses transferring technologies, utilizing agricultural production and processing byproducts. Byproducts of no or little value are transformed into energy and other salable items using technology developed at the center.

### TECHNOLOGY

The technology developed at Utah State University for profitable uses for food production and processing byproducts is manifested in two major areas: 1) anaerobic systems that can produce energy (biogas) and soil amendment from manure and food processing waste, and 2) components of a high rate aerobic bioreactor (drum composter based) system that make the process more cost effective and products produced by the process more valuable. Most of the emphasis in the year 2000 was on the anaerobic technology.

### UTAH STATE UNIVERSITY

*Can you imagine.....*



A technology utilizing agricultural byproducts of little or no value at all and transforming these byproducts into a profitable business?

### ACCOMPLISHMENTS

A fully operational system has been built at the Caine Dairy at Utah State University, open for visits to see the system functioning, creating a showcase of this technology. This technology is very unique and easy to manage, with a high treatment rate and reliability. This Center has partnered with Specialized Analysis Engineering, a Utah company, and a new company is currently being formed.

### Contact Information

**Director: Conly Hansen**  
Utah State University  
4105 University Blvd.  
Logan, UT 84322  
435-797-2188  
chansen@cc.usu.edu

# SMART SENSORS

## CENTER

Smart Sensors probe the environment and modify their function in order to improve their data gathering capability. A smart sensor adapts to its environment and sends improved data to the main processing computer. A smart sensor melds sensor, signal processing, and computer technologies. Applications span medicine, precision agriculture, electronics manufacturing, wireless communication, transportation and radar.

## TECHNOLOGY

The Center for Smart Sensors focuses on two core technologies; imbedded antennas and circuits for measuring length, distance, and impedance. Four support technologies include wireless communication, complex 3D simulation, numerical optimization, and user interfaces. Projects in the center include an early warning system for computer disk drive failure, a preflight test system for aging aircraft wiring, and a system to protect military personnel from being overrun by tanks. Antennas to communicate with implanted medical devices, measure the moisture of corn, and detect weather-critical features of atmospheric plasma are under development.

## UTAH STATE UNIVERSITY

*Can you imagine.....*



An early warning system for computer disk drive failure, a preflight test system for aging aircraft wiring and a system to protect military personnel from being overrun by tanks?

## ACCOMPLISHMENTS

Products under development include: Computer Sentinent Board, "Smart Wiring" in situ of aging wiring before flight, Imbedded Antenna for moisture measurement of corn, Imbedded Antenna for communication with medical implants, wireless communication system for environmental sensors on the H60 helicopter, water level sensor for irrigation, personnel avoidance safety system.

## Contact Information

**Director: Cynthia Furse**  
**Utah State University**  
**4120 Old Main Hill, EL 152**  
**Logan, UT 84322**  
**435-797-2870**  
**furse@ece.usu.edu**

# SOLID OXIDE FUEL CELLS

## CENTER

This center “graduated” this year. SOFC was established to develop technology for the conversion of chemical energy of oxidation of gaseous fuels such as natural gas, coal, gas, biogas, and gasifiable fuels such as gasoline and diesel, into electricity for residential and remote applications, hospitals, malls, school buildings, office buildings, etc. The objective is to develop 1 to 5 kW modular units that can be readily integrated with a fuel processor. These units will also have applications in transportation as auxiliary units. In addition, the Center technology is ideally suited for small portable power units in the 10 to 100 W range. The applications include portable power for medical devices, laptop computers, portable power for soldiers, etc.

## TECHNOLOGY

The principal Center technology is planar, anode-supported, thin YSZ film, low temperature, Solid Oxide Fuel Cell (SOFC). The main focus of the Center technology is the development of high performance, anode-supported SOFC in 5 cm x 5 cm size, and the development of stacking strategy. The stacks are internally manifolded and utilize flexible, glass-free seals. The cells and stacks are thermal shock-resistant.

## ACCOMPLISHMENTS

Center work has led to the filing of numerous invention disclosures and two patents. Center funding has facilitated the establishment of SOFC Consortium between the University of Utah, Gas Technology Institute, Electric Power

## UNIVERSITY OF UTAH

*Can you imagine.....*

A portable generator you can take on your next camping trip that efficiently converts propane to electricity with no flame, no moving parts, no noise and only water vapor as exhaust pollutant?



Research Institute and Materials and Systems Research, Inc. All four Consortium members have recently signed a Letter of Intent to form a new company for the commercialization of the Center SOFC technology. The University of Utah will be an equity participant. The Center funding has also led to other external funding from agencies such as DOE, DOC, DARPA.

## Contact Information

**Director: Anil Virkar**  
**Dept. of Science and Engineering**  
**University of Utah**  
**304 EMR**  
**Salt Lake City, UT 84112**  
**801-581-5396**  
**[anil.virkar@m.cc.utah.edu](mailto:anil.virkar@m.cc.utah.edu)**



# 2000-2001 Financial Summary

## CENTERS OF EXCELLENCE - 2000/2001 FINANCIAL SUMMARY

CENTERS FUNDED IN FISCAL 2000/2001						
	State Funding 2000/2001	Cumulative State Funding	Fed. Match 2000/2001	Private Match 2000/2001	Total Match 2000/2001	Cumulative Total Match
Acoustic Cooling Technology - U/U	\$100,000	\$100,000	\$675,000	\$10,000	\$685,000	\$685,000
Advanced Joining of Materials - BYU	\$120,000	\$230,000	\$180,000	\$116,000	\$296,000	\$694,000
Advanced Structural Composites - BYU	\$110,000	\$330,000	\$84,029	\$84,000	\$168,029	\$648,342
Biomedical Optics - U/U	\$130,000	\$250,000	\$579,334	\$0	\$579,334	\$1,108,310
Bioremediation - WSU	\$50,000	\$50,000	\$18,000	\$135,121	\$153,121	\$153,121
Cell Signaling - U/U	\$180,000	\$395,000	\$6,000,000	\$578,000	\$6,578,000	\$12,767,807
Compliant Mechanisms -BYU	\$120,000	\$230,000	\$215,103	\$172,250	\$387,353	\$760,773
Dairy Technology Commercialization - USU	\$110,000	\$345,000	\$0	\$691,113	\$691,113	\$1,520,576
Electronic Medical Education - U/U	\$120,000	\$240,000	\$100,000	\$140,000	\$240,000	\$480,000
Intelligent Computer Tools - BYU	\$110,000	\$305,000	\$0	\$831,135	\$831,135	\$3,370,537
Rapid Microbe Detection - USU	\$150,000	\$400,000	\$124,314	\$199,360	\$323,674	\$1,432,177
Multi Dimensional Information - U/U	\$100,000	\$100,000	\$416,911	\$0	\$416,911	\$416,911
Petroleum Research -U/U	\$100,000	\$100,000	\$292,000	\$374,000	\$666,000	\$666,000
Profitable uses of agricultural by-products-USU	\$100,000	\$100,000	\$189,922	\$65,000	\$254,922	\$254,922
Smart Sensors -USU	\$100,000	\$100,000	\$167,063	\$450,743	\$617,806	\$617,806
Solid Oxide Fuel Cells -U/U	\$170,000	\$500,000	\$515,000	\$0	\$515,000	\$2,172,397
<b>Subtotals:</b>	<b>\$1,870,000</b>	<b>\$3,775,000</b>	<b>\$9,556,676</b>	<b>\$3,846,722</b>	<b>\$13,403,398</b>	<b>\$27,748,679</b>
CENTERS FUNDED IN FISCAL 2000/2001:						
All Graduated Centers		\$24,048,655				\$181,148,660
All Distinguished Centers		\$5,890,440				\$147,118,784
<b>TOTALS:</b>		<b>\$33,714,095</b>			<b>\$13,403,398</b>	<b>\$356,016,123</b>
2000/2001 MATCHING RATIO	7.2	: 1				
CUMULATIVE MATCHING RATIO	10.6	: 1				

# CENTERS OF EXCELLENCE - 2000/2001: Summary of Key Commercial Accomplishments

	Spin-Off Companies New	Total	Companies Assisted	<u>Patents/Copyrights</u> Pending Issued	Licenses Signed
CENTERS FUNDED IN FISCAL 2000/2001					
Acoustic Cooling - U/U	0	0	1	0	0
Advanced Joining of Materials-BYU	0	0	50	5	1
Advanced Structural Composites - BYU	1	1	30	3	1
Biomedical Optics - U/U	0	0	9	3	2
Bioremediation - WSU	1	1	1	1	1
Cell Signaling - U/U	3	5	13	25	0
Compliant Mechanisms -BYU	0	0	9	11	4
Dairy Technology Commercialization - USU	0	1	9	4	0
Electronic Medical Education - U/U	1	1	0	2	0
Intelligent Computer Tools - BYU	0	0	9	0	2
Rapid Microbe Detection - USU	1	1	6	2	1
Multi-Dimensional Information-U/U	0	0	4	1	0
Petroleum Research - U/U	0	0	5	0	0
Profitable Uses of Agricultural Byproducts-USU	0	0	12	1	1
Smart Sensors-USU	0	0	13	4	0
Solid Oxide Fuel Cells -U/U	1	1	5	3	0
<b>Subtotals:</b>	8	11	175	65	13
ALL CENTERS TOTALLED					
<i>Graduated and Distinguished Centers Included</i>		<b>142</b>	<b>1046</b>	<b>125</b>	<b>197</b>
<b>TOTALS:</b>					



# 2001-2002 Funded Centers



## **Description of Centers selected for funding Fiscal Year 2001-2002**

**Acoustic Cooling Technology (U/U)** – has developed novel miniature acoustic cooling devices and technologies for application in electronic circuits, computers, lap-top computers, and other small scale devices.

**Advanced Joining of Materials (BYU)** – has developed new friction stir welding tools and materials and also develop appropriate control systems and multi-axial capability for all levels of manufacturing.

**Advanced Structural Composites (BYU)** - develops commercial products for the integration of damping materials with composites and the creation of lightweight composite materials.

**Biomedical Optics (U/U)** – has developed optical technologies for medical diagnostic and therapeutic (surgical) treatments in medicine, e.g. non-invasive assessment and therapeutic treatments of mucosal tissues.

**Bioremediation (WSU)** – has a patented technology for the removal of selenium metal; additional multiple metal removal technologies are poised in the commercialization pipeline. One new company has been formed.

**Cell Signaling (U/U)** - is focused on technologies important to the treatment of cancer, allergy, asthma, and inflammation. Near-term products for commercialization include chemical agents developed in the center. Two new companies have been started.

**Compliant Mechanisms (BYU)** – accelerates and streamlines commercial applications of devices that obtain their motion from the deflection of flexible parts rather than from pin joints.

**Electronic Medical Education (U/U)** - develops marketable medical education products by authoring and packaging tools that will be used to create medical education products, and sell them as a component based medical information management and processing system. A new company was formed this year.

**Nuclear, Medical and Environmental Technologies (U/U)** – develops high specific activity, short-lived radioisotopes; production of irradiated seeds for use in treatment of selected cancers; and evaluation of performance of electronic components and integrated systems upon exposure to neutrons.

**Petroleum Research (U/U)** - Develops cost-effective solutions of liquid hydrocarbon production, handling and transportation. The focus is on assessing the physical properties and chemical thermodynamics of naturally occurring hydrocarbons; optimization of enhanced petroleum recovery; process control and production automation in oil and gas fields; and the development of pipeline transportation strategies.

**Profitable Uses of Agricultural Byproducts (USU)** - develops cost-effective technologies to treat and dispose of animal waste generated in agriculture. The conversion of the waste products by anaerobic systems results in “biogas” and nutrients to be used in soil amendments.

**Rapid Microbe Detection (USU)** – has developed an immuno-flow technology to detect contaminating microbes rapidly, to enhance real time decisions in several industries including food, pharmaceutical and public health.

**Rapid Prototyping and Manufacturing (U/U)** – has developed the capability of building very large prototypes and techniques for a large number of molded parts from CAD design in a short period of time.

**Representation of Multi-Dimensional Information (U/U)** – has developed a new visualization technology that facilitates the rapid and accurate analysis of large quantities of complex and continuously changing data. The patent pending technology could be utilized in a number of areas including medicine, finance, entertainment, process control, corporate management, quality assurance, network monitoring etc.

**Smart Sensors (USU)** – is engaged in the development and commercialization of sensor-based products. Product applications span a wide array of sensing and communication needs. An application close to market is the detection of faults in aircraft wiring.

**Vascular Biotherapeutics (U/U)** – is focused on commercializing medical strategies and devices that target blood vessel formation for the treatment of cancer and obstructive vascular diseases such as atherosclerosis.

# Centers of Excellence Legislation



## **Part 6**

### **Centers of Excellence**

9-2-601. Purpose.

9-2-602. Short title - Definitions.

9-2-603. Administration - Grants.

9-2-601. Purpose.

(1) The Legislature recognizes that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. These generally come from strong research colleges and universities. Technical research in Utah's colleges and universities should be enhanced and expanded, particularly in those areas targeted by the state for economic development. Most states are enhancing their research base by direct funding, usually on a matching basis. The purpose of this part is to catalyze and enhance the growth of these technologies by encouraging interdisciplinary research activities in targeted areas. The Legislature recognizes that one source of funding is in matching state funds with federal funds and industrial support to provide the needed new technologies.

(2) The Legislature recommends that the governor consider the allocation of economic development funds for Centers of Excellence to be matched by industry and federal grants on at least a two-for-one basis.

(3) The Legislature recommends that such funds be allocated on a competitive basis to the various colleges and universities in the state. The funds made available should be used to support interdisciplinary research in specialized Centers of Excellence in technologies that are considered to have potential for economic development in this state.

History: C. 1953, 63-62-1, enacted by L. 1985, ch. 103, § 1; 1986, ch. 109, § 1; renumbered by L. 1992, ch. 241, § 60.

9-2-602. Short title - Definitions.

(1) This part is known as the "Centers of Excellence Act."

(2) As used in this part, "Centers of Excellence" means university-based, industry-supported, cooperative research and development programs.

History: C. 1953, 63-62-2, enacted by L. 1985, ch. 103, § 2; 1986, ch. 109, § 2; renumbered by L. 1992, ch. 241, § 61.

9-2-603. Administration - Grants.

(1) This part shall be administered by the Division of Business and Economic Development.

(2) The department may award grants to the various colleges and universities in the state for the purposes of this part.

(3) Recommendations for funding shall be made by the division with the advice of the State Advisory Council for Science and Technology, with the approval of the board. Each proposal shall receive the best available outside review.

(4) In considering each proposal, the division shall weigh technical merit, the level of matching funds from private and federal sources, and the potential for job creation and economic development. Proposals or consortia that combine and coordinate related research at two or more colleges and universities shall be encouraged.

(5) The State Advisory Council on Science and Technology shall review the activities and progress of individual centers on a regular basis and assist the division in preparing an annual report on the accomplishments and direction of the Centers of Excellence Program.

History: C. 1953, 63-62-3, enacted by L. 1986, ch. 109, § 3; renumbered by L. 1992, ch. 241, § 62.

Repeals and Reenactments. - Laws 1986, ch. 109, § 3 repealed former § 63-62-3, as enacted by L. 1953, ch. 103, § 3, relating to creation of a committee for technology excellence in engineering research, and enacted the above section.

